

3.8 Representations of Solutions

Name: _____ Class: _____ Date: _____ **Total: 10 marks****KEY WORDS** particle diagram 微粒图 • strong electrolyte 强电解质 • solution 溶液 • solute 溶质

Objective

Build the skills to answer exam questions on **representations of solutions** — the particle-level picture.

You must be able to:

- draw/interpret a **particle diagram** 微粒图 of a dissolved ionic compound
- show that a **strong electrolyte** 强电解质 dissolves into separate ions
- distinguish a solution of ions from a solution of molecules

1 Worked examples

Study these first. Each one shows the method for a question type used later — follow the steps and you can do the Practice and Exam-style questions yourself.

■ Ionic compounds dissolve into ions

When NaCl dissolves, it separates into Na^+ and Cl^- ions, each surrounded by water molecules (**hydrated**). A correct particle diagram shows **separate** + and – ions, not NaCl units.

■ Counting ions

One formula unit of CaCl_2 gives **three** ions in solution: one Ca^{2+} and two Cl^- . So 0.1 mol CaCl_2 releases 0.1 mol Ca^{2+} and 0.2 mol Cl^- .

■ Molecular solutes stay whole

A molecular solute like sugar or ethanol dissolves as **whole molecules** — no ions form, so the solution does **not** conduct electricity.

■ Electrolytes vs non-electrolytes

A **strong electrolyte** (soluble ionic compound, strong acid) fully separates into ions and conducts; a **non-electrolyte** (sugar) stays molecular and does not conduct.

2 Practice

Now apply the methods above.

2.1 What ions form when KBr dissolves? [1]

2.2 How many ions are released per formula unit of Na_2SO_4 ? [1]

2.3 Does a sugar solution conduct electricity? Give a reason. [2]

3 Exam-style questions

3.1 A particle diagram of dissolved NaCl should show [1]

- A** NaCl units floating together
- B** separate Na^+ and Cl^- ions
- C** Na and Cl atoms
- D** Cl_2 molecules

3.2 0.20 mol of CaCl_2 is dissolved in water.

(a) Write the dissociation and the moles of each ion. [2]

(b) Find the total moles of ions in solution. [1]

3.3 Explain why a solution of NaCl conducts electricity but a solution of glucose does not. [2]

Solutions

2.1 K^+ and Br^- .

2.2 Three (two Na^+ and one SO_4^{2-}).

2.3 No — sugar dissolves as neutral molecules, so there are no free ions to carry charge.

3.1 B — separate hydrated Na^+ and Cl^- ions.

3.2 (a) $\text{CaCl}_2 \rightarrow \text{Ca}^{2+} + 2\text{Cl}^-$; 0.20 mol Ca^{2+} and 0.40 mol Cl^- . (b) $0.20 + 0.40 = 0.60$ mol ions.

3.3 NaCl separates into mobile ions that carry charge; glucose stays as neutral molecules with no ions, so it cannot conduct.